



A QUALITATIVE STUDY ON THE VARIABILITY IN INTONATION LEARNING AND ATTRITION IN BRAZILIAN PORTUGUESE BILINGUAL SPEAKERS OF SPANISH L2

ESTUDO QUALITATIVO SOBRE A VARIABILIDADE NA APRENDIZAGEM E ATRITO NA ENTOAÇÃO EM FALANTES BILÍNGUES DE PORTUGUÊS BRASILEIRO DE ESPANHOL L2

Cristiane Silva¹
Pablo Arantes²

Resumo: Analisamos neste estudo a produção de contornos de frequência fundamental de falantes bilíngues brasileiros residentes na Espanha. Sua produção em espanhol L2 foi comparada à de nativos espanhóis e sua produção em português L1 à de falantes monolíngues do português brasileiro. A análise é de base qualitativa, realizada a partir da observação visual de padrões em contornos de f_0 normalizados temporalmente. Foram comparadas frases em três modalidades, declarativas, interrogativas totais e interrogativas pronominais, elicitadas em dois estilos de elocução - lidas isoladamente e inseridas em uma narrativa. Na análise, observamos evidência favorável à presença de dois fenômenos relacionados ao bilinguismo: aprendizagem, na forma de padrões produzidos em espanhol L2 que se aproximam aos observados na fala nativa dos espanhóis e atrito linguístico, manifesto no aparecimento de padrões produzidos pelos bilíngues na sua L1 que são semelhantes aos encontrados no espanhol nativo. Os dois fenômenos manifestam-se de forma gradiente e variável entre os falantes analisados. Identificamos padrões nas produções de contornos de f_0 dos bilíngues e propomos uma classificação preliminar dos comportamentos variáveis em termos de incorporação de características do espanhol nativo na produção de L2 (aprendizagem) e da transferência para o português de traços entoacionais do espanhol (atrato). Na discussão dos resultados, apontamos uma possível relação entre a ocorrência de aprendizagem e atrito e a experiência dos falantes com L2, em especial tempo de residência na Espanha e de estudo formal do espanhol e quantidade de uso de L1. Propomos, com base no modelo Speech Learning Model (SLM-r), entender a manifestação diferencial dos dois processos nas três modalidades sentenciais estudadas como resultado da interação entre os diferentes repertórios tonais do espanhol e do português brasileiro.

Palavras-chave: entoação, atrito linguístico, Espanhol L2 e Português brasileiro L1

Resumen: En este estudio analizamos la producción de contornos de frecuencia fundamental por parte de hablantes brasileños bilingües que vivían en España. Su producción en español L2 se comparó con la de hablantes nativos de español y su producción en portugués L1 con la de hablantes monolingües de portugués brasileño. El análisis es cualitativo, basado en la observación visual de patrones en contornos de f_0 normalizados temporalmente. Se compararon enunciados en tres modalidades, declarativa, interrogativa total e interrogativa pronominal, elicitados en dos estilos de elocución - leídos separadamente e insertados en una narración. En el análisis observamos evidencias favorables a la presencia de dos fenómenos que se relacionan con el bilingüismo: el aprendizaje, en forma de patrones producidos en español L2 similares a los observados en el habla del español nativo, y la erosión lingüística, que se manifiesta en la aparición de

1 Federal University of Santa Catarina (UFSC), Florianópolis, SC, Brasil. cristiane.conceicao@ufsc.br
Orcid: <https://orcid.org/0000-0002-2086-8523>

2 Adjunct Professor, Federal University of São Carlos (UFSCar) São Carlos, Brazil.
pabloarantes@ufscar.br
Orcid: <https://orcid.org/0000-0001-9707-8493>

patrones producidos por bilingües en su L1 que son similares a los que se encuentran en el español nativo. Los dos fenómenos ocurren de forma gradual y variable entre los hablantes analizados. Identificamos patrones en la producción de contornos de f_0 por parte de los bilingües y proponemos una clasificación preliminar de comportamientos variables en términos de incorporación de características nativas del español en la producción de L2 (aprendizaje) y la transferencia al portugués de características de la entonación del español (erosión). En la discusión de los resultados, señalamos una posible relación entre la ocurrencia de aprendizaje y la erosión y la experiencia de los hablantes con la L2, especialmente el tiempo de residencia en España y estudio formal del español y la cantidad de uso de L1. Proponemos, con base en el Speech Learning Model (SLM-r), comprender la manifestación diferencial de los dos procesos en las tres modalidades de enunciado estudiadas como resultado de la interacción entre los diferentes repertorios tonales del español y el portugués brasileño.

Palabras clave: entonación, erosión lingüística, Español L2 y Portugués brasileño L1

1. INTRODUCTION

According to Cutler and colleagues (1997), prosody is a major factor determining the form of spoken language. It is related to changes in timing, amplitude and frequency in the speech signal. In this sense, as part of prosody, intonation plays an important role in speech communication. Intonation can convey linguistic information, it can regulate discourse, indicate speaker identity, age and gender and also can reflect sociolinguistic information and psychological state (MENNEN, 2007).

Thus, to understand intonation learning in L2 is also essential. According to Mennen (2007), there are still few studies about L2 intonation and most of them analyze the production of English intonation as L2 by learners of different language backgrounds. She points out that those studies focus mainly on transfer, that is, the L1 influence on the intonation of L2. Furthermore, there are few studies featuring Brazilians learning Spanish L2 intonation in a more naturalistic setting (OLIVEIRA, 2013; RENATO, 2016; SILVA, 2016) and most studies use frameworks that assume categorical primitives (discrete high and low tones) that may not be appropriate to analyze the highly variable production of bilinguals (PINTO, 2009; REBOLLO *et al.*, 2010; SÁ, 2008; SILVA *et al.*, 2011). As far as we know, there is only one L2 learning model that describes intonation learning in a second language: the L2 Intonation Learning Theory (LILt) model, proposed by Mennen (2015). According to the model, the cross-language differences in intonation occur along four different dimensions. The first is the systemic dimension, related to structural phonological elements, such as differences in pitch accents and boundary tones inventory that may differ between L1 and L2. The second dimension has to do with how the systemic elements are phonetically implemented. Examples of differences this dimension given by the authors are “how pitch accents are lined up with the segments of utterances (usually referred to as tonal alignment), how they are scaled (i.e. what their relative height is) or what their shape or slope is (e.g. shallow versus steep rising or falling pitch accents, pitch accents with a clear peak versus flat or plateau pitch accents)” (MENNEN, 2015, p. 174). The third dimension concerns the relation between structural elements and their use for conveying meaning, since languages are different in terms of how they mark linguistic functions such as interrogativity and focus using intonational means. As an example, the author mentions that “in most varieties of English, questions are signalled by rising pitch, whereas in Greek yes/no question falling intonation is used” (MENNEN, 2015, p. 175). Lastly, the fourth dimension has to do with the possible cross-language differences/similarities in the frequency of use or distribution of the intonational primitives present in each language inventory. As examples of this, the author points out that “rises are far more frequent in Belfast English than in London or Cambridge English (Grabe 2004). Similarly, Mennen *et al.* (2012) found that rises are more commonly used by female speakers of Northern Standard German than by female speakers of Southern

Standard British English (at least in read speech)” (MENNEN, 2015, p. 175). By analyzing cross-language differences in intonation in those four dimensions, it would be possible to recognize and analyze different sources of learning deviations. Although it is an interesting and innovative model in the sense that it is the first to try to describe and analyze intonation in L2, it is exclusively aimed at analyzing the deviation/transfer/influence of L1 on L2.

In addition to the L1 influence/transfer, which is one of the central issues related to L2 learning, the influence of L2 on L1 can also occur and up until recently was much less studied, especially at the level of prosody. The influence that L2 can have on L1 has been studied under the field known as “language attrition” and as a phenomenon, it can be defined as a “non-pathological, non-age related, structural change of an L1 within a late bilingual, assuming that the acquisition of the L1 precedes this change” (DE LEEUW; MENNEN; SCOBIE, 2012, p. 3). According to Schmid and Köpke (2017), attrition refers to both the more extensive changes in L1 that bilinguals with decades of no or very little exposure to L1 can experience, and also the changes in L1 that early L2 learners can experience. Language attrition phenomena in a broad range of linguistic domains, such as lexical access, semantics, syntax and phonology have been documented in the literature (SCHMID, MONIKA, 2011). Kupske (2021) highlights that the most common scenario in which language attrition can occur is in L2-dominant contexts. However, it has been shown that attrition can also occur in L1-dominant contexts as well (SCHERESCHEWSKY; ALVES; KUPSKE, 2019).

In this sense, L2 learning models such as the revised Speech Learning Model (SLM-r) (FLEGE; BOHN, 2021) which, although not designed to analyze prosody, seems to explain more fully the mutual influence between L2 and L1. The model assumes that L1 and L2 sounds exist in a common phonetic space. This entails the possibility of bi-directional influences between L1 and L2 sound systems. Previous studies demonstrated that this bi-directional influence can occur at both segmental (FLEGE, 1987) and prosodic levels (MENNEN, 2004; SILVA; ARANTES, 2021). Mennen (2004), for example, studied the tonal alignment in sentences produced by Dutch and Greek monolingual speakers compared with parallel production of Dutch bilingual speakers of Greek L2. Her results showed positive evidence in favor of the occurrence of both learning and attrition. In a quantitative analysis of the intonation in Spanish (L2) and Brazilian Portuguese (L1), Silva and Arantes (2021) found that the production of bilinguals are significantly more variable than the Spanish and Brazilian monolinguals. They also found evidence in favor of both learning and language attrition.

The goal of the present study is to conduct a qualitative analysis of f_0 contours produced by Brazilian bilingual speakers in both Spanish L2 and Brazilian Portuguese (henceforth BP) L1 and compare them to control contours produced by Spanish L1 and BP L1 monolingual speakers. The analysis will provide evidence for L2 learning and/or attrition in intonation and also will help us to identify contours features to be analyzed quantitatively in a future study.

This work is organized as follows. In section 2, we present a literature review about the declarative, yes-no and wh-question sentence intonations in Spanish and BP L1 and also in Spanish L2. In section 3, we present the analysis method. In sections 4 and 5, we discuss the results and, lastly, the conclusions.

2. CHARACTERIZING SPANISH AND BRAZILIAN PORTUGUESE INTONATION

2.1 Intonation of Spanish as L1

Intonation of declarative and interrogative sentences in Castilian Spanish has been studied extensively. We refer the reader to Silva (2016) for a detailed discussion on the different perspectives found in the relevant literature (ESTEBAS-VILAPLANAS; PRIETO, 2010; FACE, 2005; NAVARRO TOMÁS, 1999; QUILIS; FERNÁNDEZ, 2003; SOSA, 1999). Here we present a brief description of the results relevant to the discussion of our results.

Quilis and Fernández' (2003) analysis describes declarative sentences as having a falling f_0 contour in the final position. Yes-no questions have a final f_0 rising and usually this movement continues up to the last stressed syllable in the sentence. Pronominal or wh-questions have a falling final contour, making it similarly to declaratives. The difference would be the presence of an interrogative pronoun. They also describe cases of final rising f_0 contour in wh-questions would, according to the authors, trigger the interpretation that the speaker is expressing attitudes such as politeness (QUILIS; FERNÁNDEZ, 2003, p. 177). Navarro Tomás (1999, p. 230) identified a third configuration for wh-questions, a final circumflex (or rise-fall) contour, conveying "surprise" or "strangeness". Henriksen (2009) found a fourth contour, described as a nuclear falling pattern: a peak on the wh-word, followed by a plateau that lasts until the nuclear stressed syllable, ending the sentence with a falling movement. The author suggests that the circumflex pattern is preferred in more spontaneous or naturalistic speech settings.

2.2 Intonation of Brazilian Portuguese as L1

As with Spanish, the intonation of declarative and interrogative sentences has also been extensively studied. We refer the reader to Silva (2016) for a more detailed presentation of the relevant research (FROTA; MORAES, 2016; LUCENTE, 2008, 2012; MORAES, 1998; MORAES, 2008; TENANI, 2002; TRUCKENBRODT; SANDALO; ABAURRE, 2008). The description presented here is based on the didactic presentation of the subject by Frota and Moraes (2016).

Frota and Moraes (2016) describe declarative sentences as having one pitch accent per prosodic word in prenuclear position. Non-final stressed syllables typically exhibit a rising melody. The nuclear contour is implemented as a circumflex movement, followed by a low boundary tone. The authors describe the contour of a yes-no question as being implemented as a circumflex movement in the nuclear syllable with a late alignment of the f_0 peak to the stressed syllable, followed by a falling movement in the post-stressed syllable. Wh-questions are described as having an extra high initial f_0 peak aligned to the wh-word in pre-nuclear position, followed by a gradual transition over the following syllables up to a low f_0 level on nuclear position.

2.3 Intonation of Spanish L2

There are some studies about the intonation of declarative and interrogative sentences in Spanish as L2 spoken by Brazilians. Most of them analyzed the productions of Brazilians who learned Spanish in Brazil and based their analysis in AM theory by comparing the pre-nuclear and nuclear pitch accents in Spanish L2 and in Spanish L1

(PINTO, 2009; REBOLLO *et al.*, 2010; SÁ, 2008; SILVA, CAROLINA; REBOLLO; PINTO, 2011).

Sá (2008) for example analyzed the intonation production of two Brazilians and one Spanish speaker and compared the pre-nuclear and nuclear pitch accents of declarative, yes-no and wh-questions. She found more transfer contours in interrogatives than in declarative sentences. Just like Sá (2008), Pinto (2009) also found a high degree of transfer from BP L1 to Spanish L2 both in the shape of the contours and in tone alignment.

More recent research analyzed Spanish intonation L2 production of Brazilians in immersion situations (OLIVEIRA, 2013; SILVA, 2016) as well as in learning contexts that include other Spanish varieties, such as Colombian (DIAS, 2015) and Argentinian (RENATO, 2016) and from different theoretical perspectives (OLIVEIRA, 2013; SILVA, 2016).

Oliveira (2013) analyzed spontaneous speech data (interview style) from twelve Brazilians from different states who lived in Barcelona and Valladolid. She analyzed 511 sentences (152 declaratives, 28 yes-no and 15 wh-questions). In declaratives she observed three different final contours: slight fall (45%), steeper fall (38%) and circumflex (17%). In yes-no questions and wh-questions the author also observed variability in the final contours. In yes-no sentences speakers produced ascending (57%), circumflex (33%) and very smooth fall (8%) contours. Oliveira's results highlight a gradient variability in the production of the f_0 contours in Spanish L2. In each of the modalities analyzed, the author observed the occurrence of three types of final contours.

The variability was also observed by Silva (2016), who analyzed the production of 15 Brazilians who lived in Madrid. Using the PENTA model (XU; PROM-ON, 2014), the author analyzed three communicative functions: prominence, boundary and modality (declarative, yes-no and wh-questions). Analyzing, for example, the prominent word in final boundary position of declarative sentences of Spanish L1, BP L1 and Spanish L2 the author found in the final contour of the last prominent word of the sentence a smoother fall towards the low boundary (Spanish L1) and a sharper final fall (BP L1) and in Spanish L2 there was greater variability (a mixture of smooth and sharp final falls).

In addition, the author also found that bilinguals achieved a partial learning in yes-no and wh-questions as well. The speakers could reproduce aspects of Spanish L1 f_0 contours, although L1 transfer was still present. One unanticipated result in Silva's data is the fact that L1 production of bilingual speakers showed more variability in the implementation of tonal patterns than what was expected by the traditional description of BP intonation as described in section 2.2. More strikingly, a number of BP L1 contours presented patterns similar to those expected in Spanish L1. Silva pointed to language attrition as a possible explanation for this L2 to L1 transfer, although her corpus lacked data produced by BP monolingual speakers in order for a proper comparison to be made.

3. METHODOLOGY

Speakers. In this study we analyzed data from five native speakers of Spanish (3 female and 2 male) and five native speakers of BP (3 female and 2 male). Three Spanish speakers are from Madrid, one from Segovia and another from Ciudad Real (both cities are close to Madrid). All of them are college-educated and were aged between 22 and 33 years (mean 28 years) at the time the data was collected. The five monolingual native BP speakers are from São Paulo State. All of them are college-educated or college students, aged between 19 and 42 years (mean 25 years) at the time the data was collected. The

Spanish group never studied Portuguese as L2 and the BP group never studied Spanish as L2. The Spanish monolingual group contributed the Spanish L1 data (referred to from now on as MS) and the BP monolingual group contributed the Portuguese L1 data (henceforth referred to as MP).

The bilingual group consisted of fifteen native speakers of BP (10 female and 5 male) that speak Spanish as L2. They are from São Paulo State, college-educated, aged between 27 and 48 years (mean 35) at the time the data was collected. All started learning Spanish after the age of 18 and lived in Madrid at the time of the recordings. The length of residence in Madrid ranged from six months to 16 years (mean 6 years). Ten speakers in this group studied Spanish in Brazil before moving to Spain. This group contributed with two sets of recordings: Spanish as L2 (henceforth BL2) and BP (henceforth BL1).

Speech Material. Participants read an excerpt of an adaptation of *Don Quijote de La Mancha* for teenagers (SÁNCHEZ AGUILAR, 2004). The excerpt chosen was taken from the beginning of the *Gigantes con aspás* chapter, which tells the episode when *Don Quijote* fights against windmills. The excerpt was modified by the first author. The final version was shortened to 72 sentences and contained sentences in three modalities: declarative, yes-no questions and wh-questions. This material was read by the MS and BL2 groups. The MP and BL1 groups read a BP version of the material, translated by the first author. The translation tried to keep the two versions as parallel as possible while respecting each language structure. After reading the whole excerpt twice, 39 isolated sentences (15 declaratives, 12 yes-no and 12 wh-questions) from the excerpt were chosen to be read in isolation in random order. Each sentence was read three times. For the bilingual group, the Spanish version of the material was presented first and then the Portuguese translation. The instructions were read by the experimenter in Spanish and BP, respectively.

In this study, we are going to analyze a subset of three sentences from each language, one in each modality (declarative, yes-no and wh-question). Both read text (the whole 72-sentence story) and sentences read in isolation were included. In table 1 we present the sentences analyzed in both languages:

Table 1: Sentences in Spanish and Portuguese analyzed in this study. Stressed syllables are in bold.

Modality	Spanish	Portuguese	English translation
Declarative	Me dijo que se llamaba Fritón.	Ele me disse que se chamava Fritão.	He told me his name is Fritón.
Yes-no question	Amigo Sancho , ¿ tienes miedo ?	Amigo Sancho , tens medo ?	Dear Sancho, are you afraid?
Wh-question	¿ Dónde están mis libros ?	Onde estão meus livros ?	Where are my books?

As mentioned before, monolingual speakers performed the experiment in one language only (Spanish for monolingual Spanish speakers and Portuguese for monolingual Brazilian speakers). Bilingual speakers performed the experiment in two languages (Spanish and Portuguese). The number of sentences analyzed in each group is 75 (3 sentences × 5 repetitions × 5 speakers) for MS and MP and 225 (3 sentences × 5 repetitions × 15 speakers) for BL2 and BL1. Sixteen sentences were excluded from the total of 600 because of reading errors.

Phonetic analysis. Fundamental frequency contours for each audio sample in the data set were extracted with the help of Praat scripts (ARANTES, 2019). Raw f_0 contours were smoothed with a bandwidth of 2 Hz using Praat's *Smooth* function and each contour was

then converted to the semitone scale relative to the contour's minimum f_0 value. The processed contours were then time-normalized with the help of another Praat script (ARANTES, 2021). We refer readers unfamiliar with the time-normalization technique as it may be applied to f_0 contours to Arantes (2015) for a didactic presentation on the subject. Syllables were used as the normalization interval and five f_0 samples were extracted in each interval. Table 2 lists the number of syllables in test sentences as a function of modality and language. The total number of f_0 samples in time-normalized contours is the number of units (syllables) times 5.

Table 2. Number of syllables in test sentences as a function of sentence modality and language.

Language	Declarative	Yes-no question	Wh-question
Spanish	9	9	6
Brazilian Portuguese	12	9	6

4. RESULTS

In section 4.1 we present the results for monolingual Spanish and Brazilian speakers for declarative, yes-no and wh-questions. We present qualitative results for each language group and discuss in detail the main intonation characteristics of the three modalities in both languages. In section 4.2 we present the results for bilingual speakers (BL2 and BL1 groups). We also describe the main characteristics of the intonation in the production of the bilingual speakers in the three modalities, comparing these results with the monolingual data. In this section, aspects of L2 learning, L1 transfer and language attrition are discussed.

In the following analysis, the expression “nuclear” is used as a descriptive term to refer to a contour or f_0 movement that occurs in the last prominent word of the sentence being analyzed. Prenuclear, by extension, refers to the contour parts that precedes the nuclear contour/movement. Lastly, when describing individual contours, we will use labels such as *f1* and *m1* to refer to female and male participants, respectively.

4.1 Monolingual contours

In this section we analyze the f_0 contours of the monolingual groups (Spanish and Brazilian speakers) in the three modalities (declarative, yes-no and wh-questions).

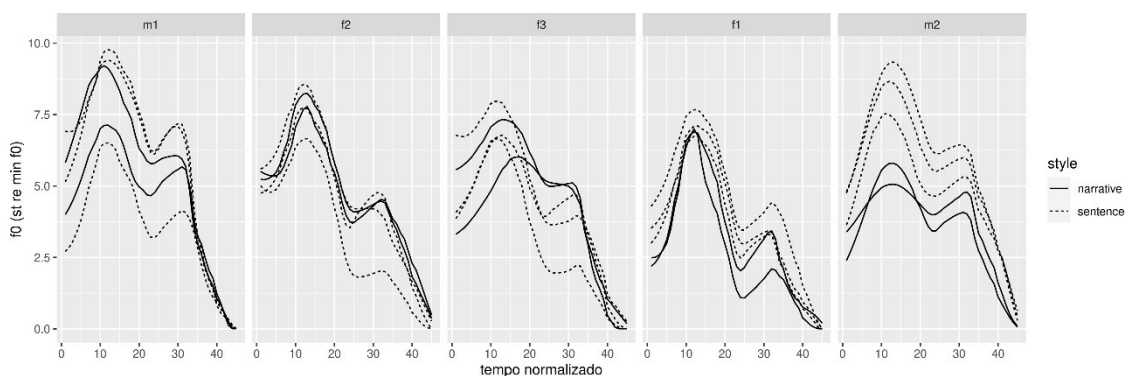


Figure 1. Time-normalized f_0 contours of declarative sentences by monolingual speakers of Spanish.

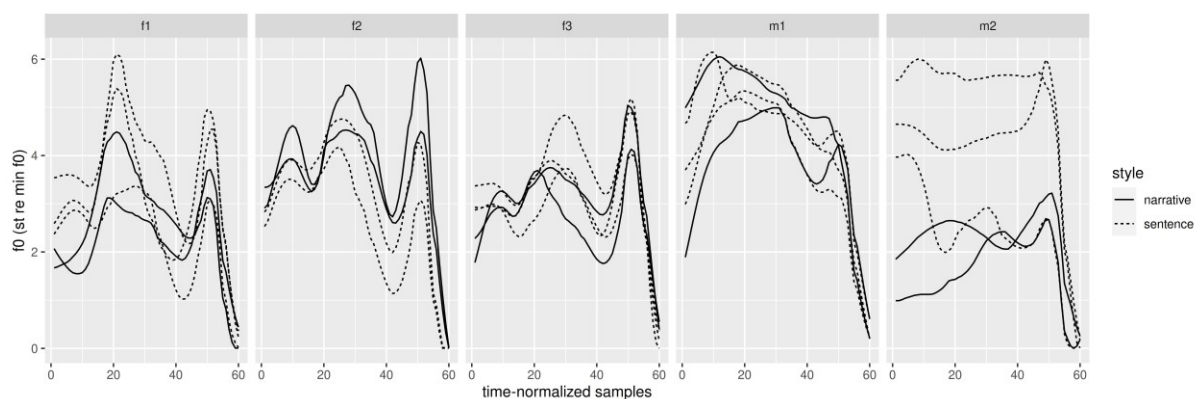


Figure 2. Time-normalized f_0 contours of declarative sentences by monolingual speakers of BP.

Visual examination of the f_0 contours of Spanish declaratives in figure 1 suggests that all speakers present a very similar pattern: two clear f_0 peaks, the second one systematically downstepped relative to the first; also, the nuclear accent is implemented as a circumflex contour with a smooth falling. Examination of BP declarative contours, shown in figure 2, suggests that, overall, there is more intra and interspeaker variation compared to the Spanish speakers. The prenuclear region can have a plateau-like pattern or a series of two or three f_0 peaks. When present, peaks do not always show the downstep pattern seen in the MS group. The nuclear accent is also realized by a circumflex contour, although the fall appears to be steeper than what is seen in the Spanish contours. This difference may be the result of BP speakers aligning the circumflex fall later than Spanish speakers.

In yes-no question contours in Spanish, shown in figure 3, the nuclear accent is realized as a final rise; the final rise ends in a fairly high value, around 10 st relative to each contour minimum f_0 for three of the speakers ($m1$, $f1$ and $f2$), whereas the final rise does not go up to that level for the other two speakers. The prenuclear part is relatively flat for three speakers ($f1$, $f2$ and $f3$), but speakers $m1$ and $m2$ present a more varied prenuclear contour. In yes-no question contours in BP, shown in figure 4, the nuclear accent is realized as a circumflex contour; there is a great deal of interspeaker variability in the implementation of this contour - the circumflex pattern is not present in the contours produced by $m2$, for instance. As with the Spanish group, the prenuclear part of the contours shows a great deal of variability in the number of f_0 movements and their location within the sentence. The variability in the prenuclear part may be due to the syntactic structure of the sentence. Speakers phrased the initial vocative (*Amigo Sancho*) differently. Because of that, only the nuclear part will be shown in Figures 3, 4, 8 and 11 (*¿Tienes miedo?* in Spanish and *Tens medo?* in BP).

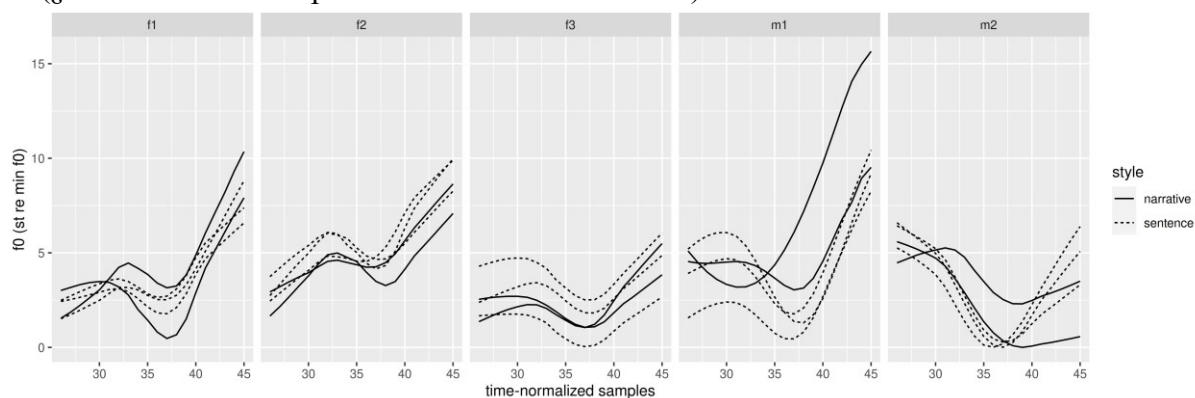


Figure 3. Time-normalized f_0 contours of yes-no questions by monolingual speakers of Spanish.

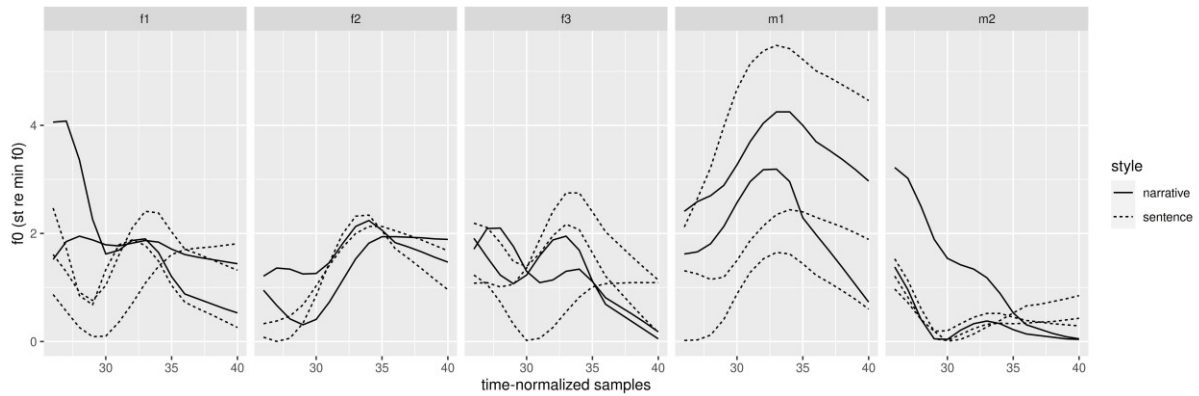


Figure 4. Time-normalized f_0 contours of yes-no questions by monolingual speakers of BP.

In wh-question contours in Spanish, shown in figure 5, there are three recognizable contours patterns: the first has a high prenuclear accent followed by a final rise; the second pattern has a plateau followed by a nuclear circumflex movement and the third has a high prenuclear accent, followed by a downstepped nuclear circumflex. Speakers *f2* and *f3* consistently used the first in the isolated sentence style and the second in the narrative style; speaker *m1* mostly used the first and speaker *m2* mostly the third; speaker *f1* used only the second pattern. In BP contours, shown in figure 6, the speakers are consistent in applying one pattern: extra high prenuclear movement (the peak for all speakers range from approximately 5 to 12 st) that transitions smoothly to a low nuclear accent.

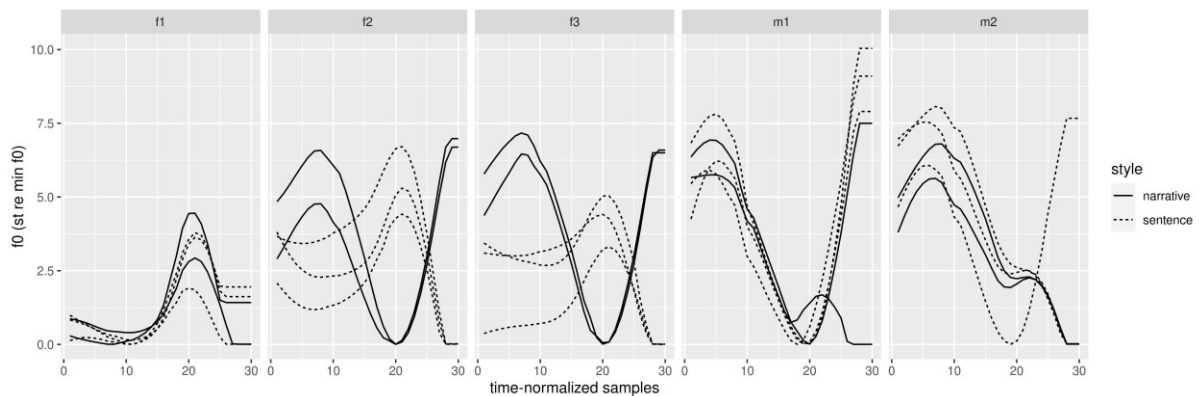


Figure 5. Time-normalized f_0 contours of wh-questions by monolingual speakers of Spanish.

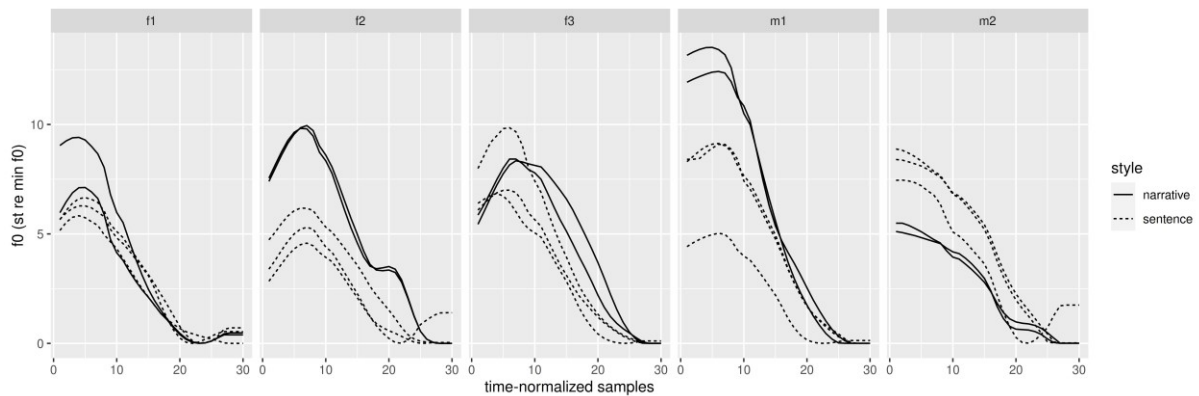


Figure 6. Time-normalized f_0 contours of wh-questions by monolingual speakers of BP.

4.2 Bilingual contours

In this section we analyze the f_0 contours of the bilingual group in the three modalities (declarative, yes-no and wh-questions). We refer to the condition where the bilinguals speak Spanish as L2 as **BL2** and to the condition where they speak BP as **BL1**.

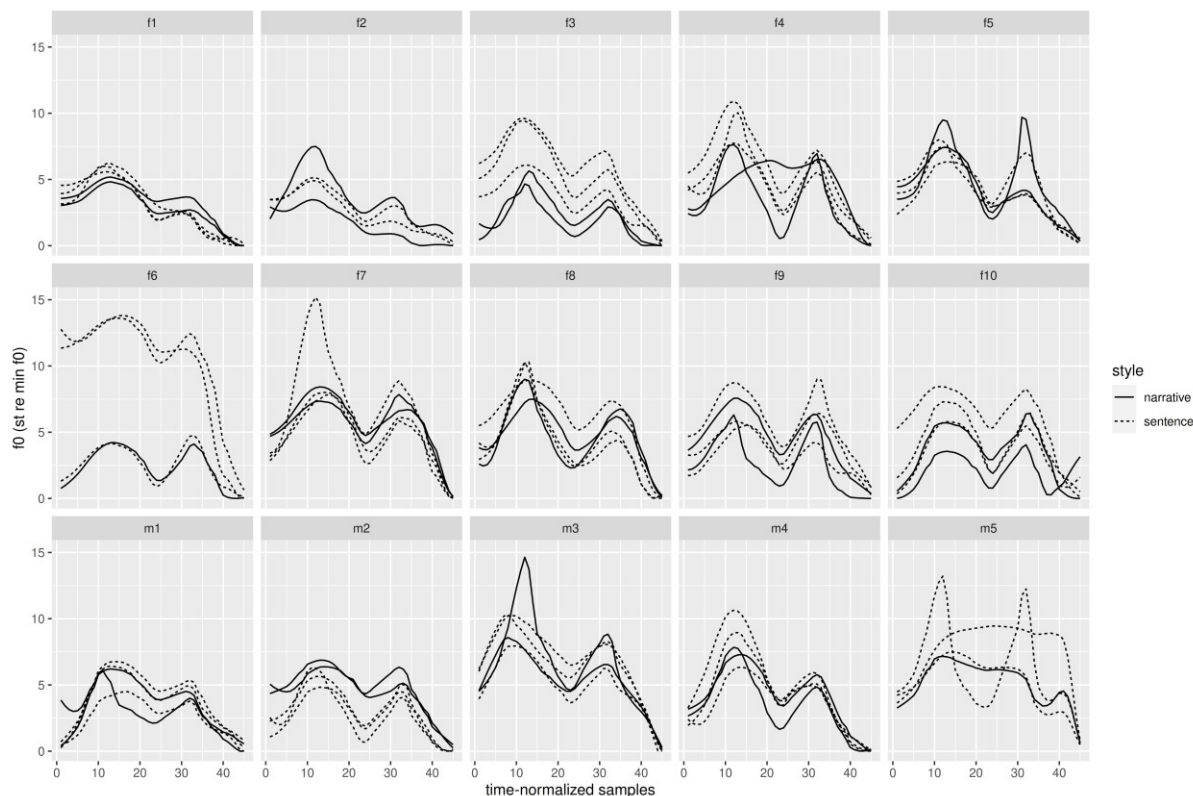


Figure 7. Time-normalized f_0 contours of declarative sentences by bilingual speakers of Spanish as L2 (BL2).

In declarative sentences in Spanish L2, shown in figure 7, we identified a group of speakers that produced patterns similar to the Spanish L1: two well-defined f_0 peaks and a final smooth fall contour; one difference with relation to the L1 contours, though, is that the downstep of the second peak is not as consistent as in the L1 speakers, with the exception of speaker *m4*. We include 73% of the speakers in this group: *f3* to *f10* and *m2* to *m4*. A second group includes speakers *f1*, *f2* and *m1*. Their contours show two peaks, although not as well-defined as the ones in the first group. Finally, speaker *m5* is unique within this group. Three out of four of his contours are a plateau followed by a sharp falling movement in the nuclear accent; a pattern similar to monolingual BP speaker *m2*.

Since the first group produced Spanish L2 contours that have a number of similarities to the Spanish native contours, we interpret this as evidence of learning. We see speaker *m5* production as an example of L1 transfer, although one of his contours came close to the Spanish native pattern. The second group is in an in-between state: their contours have some plateau-like characteristics blended with peaks with limited excursion.

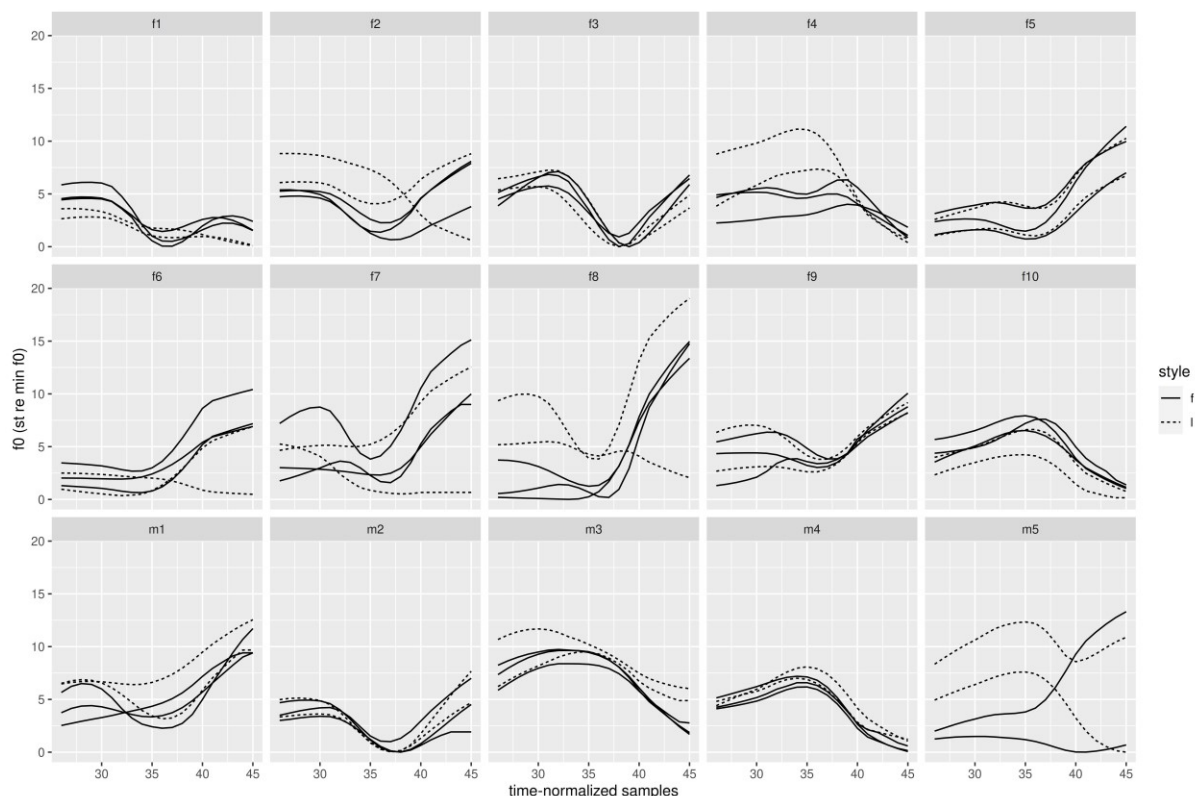


Figure 8. Time-normalized f0 contours of yes-no questions by bilingual speakers of Spanish as L2 (BL2).

In the yes-no questions, shown in figure 8, we identified three groups. Five speakers, or 33% of the sample (*f3*, *f5*, *f9*, *m1* and *m2*) systematically produced a final rise contour on the nuclear accent, the pattern expected in Spanish L1. A second group is composed of five speakers (*f2*, *f6*, *f7*, *f8* and *m5*). In this group, speakers present both the Spanish L1-like final rise contour on the nuclear accent and the circumflex movement that is typical in BP L1. For most speakers, the final rise contour outnumbers the circumflex pattern. In the third group (*f1*, *f4*, *f10*, *m3* and *m4*), all speakers systematically produced the circumflex movement in the nuclear accent, the typical pattern in BP L1.

As with the declarative modality, we see gradience in the learning-transfer dynamics. The production of the first and third groups tends towards the ends of the continuum (either typical Spanish L1 or BP L1) and the second group is in an intermediary position, although closer to the first group.

In the wh-questions, shown in figure 9, three different groups were also identified. In the first group, we include six speakers: *f1*, *f2*, *f9*, *f10*, *m1* and *m2*. In this group, speakers produce a contour more or less identical to the BP L1 pattern: an extra high peak on the initial wh-word followed by a smooth transition to the low nuclear accent. The second group includes four speakers (*f5*, *f6*, *f7* and *f8*). In this group, speakers produce either a contour similar to the one BP L1 speakers use or one of the three contour types Spanish L1 speakers use (see figures 5 and 6).

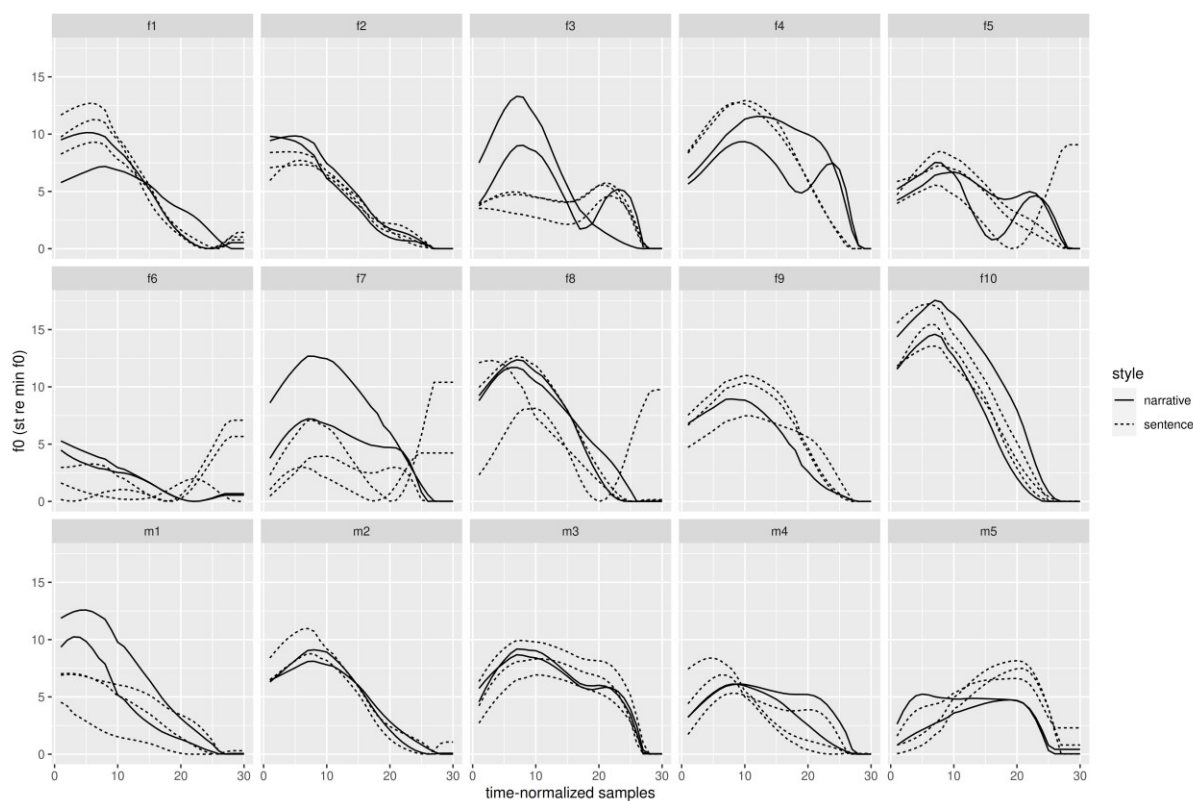


Figure 9. Time-normalized f_0 contours of wh-questions by bilingual speakers of Spanish as L2 (BL2).

Finally, the third group includes three speakers (*m3* to *m5*). In this group, speakers produce what we might call a “hybrid” pattern, i.e., contours that could be seen as the result of combining traits of both Spanish L1 and BP L1 contours. The contours produced by speakers *m3* and *m4* are examples of this blend: instead of the extra high tone on the wh-word expected in BP L1, we see a lowered high peak; instead of a more prominent circumflex movement in the nuclear accent expect in Spanish L1, we see a circumflex with limited excursion size. As a result, the sentences have a unique f_0 contour that is not typical neither in Spanish L1 nor BP L1. Lastly, only speaker *f3* produces more Spanish L1-like contours compared to the other two groups. That speaker produced either a contour similar to the monolingual BP L1 speakers and four instances of the two types of circumflex contour used in Spanish L1.

In declarative sentences of BP L1 produced by Brazilian bilingual speakers (BL1 condition), shown in figure 10, all speakers produce the nuclear accent by means of a circumflex contour, as would be expected in BP L1. It is striking, though, that instead of the more steep final fall we see in monolingual BP speakers (figure 2), the bilingual speakers present a smoother movement, initiated earlier than the typical monolingual production. We interpret this as evidence in favor of attrition, since bilinguals are applying a feature common in the L2 (Spanish) to their native language (BP). It is interesting to note that all speakers seem to present this behavior.

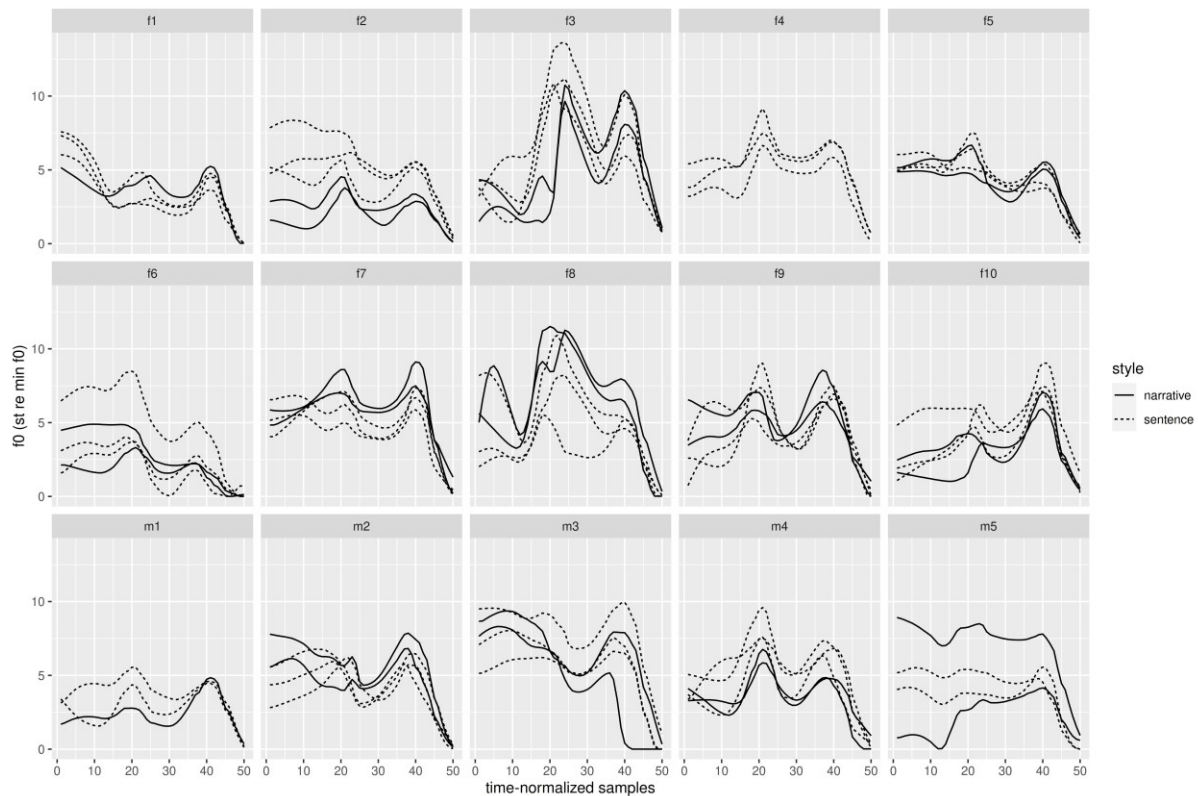


Figure 10. Time-normalized f_0 contours of declarative sentences by bilingual speakers of BP as L1 (BL1).

Other aspects of the contours, though, do not seem to be affected by attrition. A group of six speakers (*f4*, *f7*, *f10*, *m1*, *m3* and *m5*) produce a plateau-like prenuclear pattern seen in some of the monolingual BP speakers (see Figure 2). A second group (*f3*, *f9* and *m4*) presents a pattern with two major peaks, one in prenuclear and the other in nuclear position. This pattern is also seen in monolingual BP speakers and does not show the downstep peak feature seen in most native Spanish contours (see Figure 1).

In yes-no questions, shown in figure 11, a group of six speakers (*f1*, *f2*, *f4*, *f7*, *m4* and *m5*) produces contours that are very similar to the ones produced by the monolingual BP speakers - a circumflex movement in nuclear position. In this group, all contours have this basic shape.

A second group of eight speakers (*f3*, *f5*, *f6*, *f8*, *f10*, *m1*, *m2* and *m3*) produces some contours with the Spanish L1 yes-no final rise pattern, but also contours similar to the typical BP L1 pattern, that is, with a circumflex in nuclear position. Speakers in this group vary in terms of the ratio of Spanish- and BP-like contours they produce. Speaker *f9* can be singled out because all her contours in BP L1 follow the Spanish L1 pattern, that is, nuclear accent realized as a final rise. Results show, then, that for 9 out of 15 speakers there is evidence for either total or partial attrition.

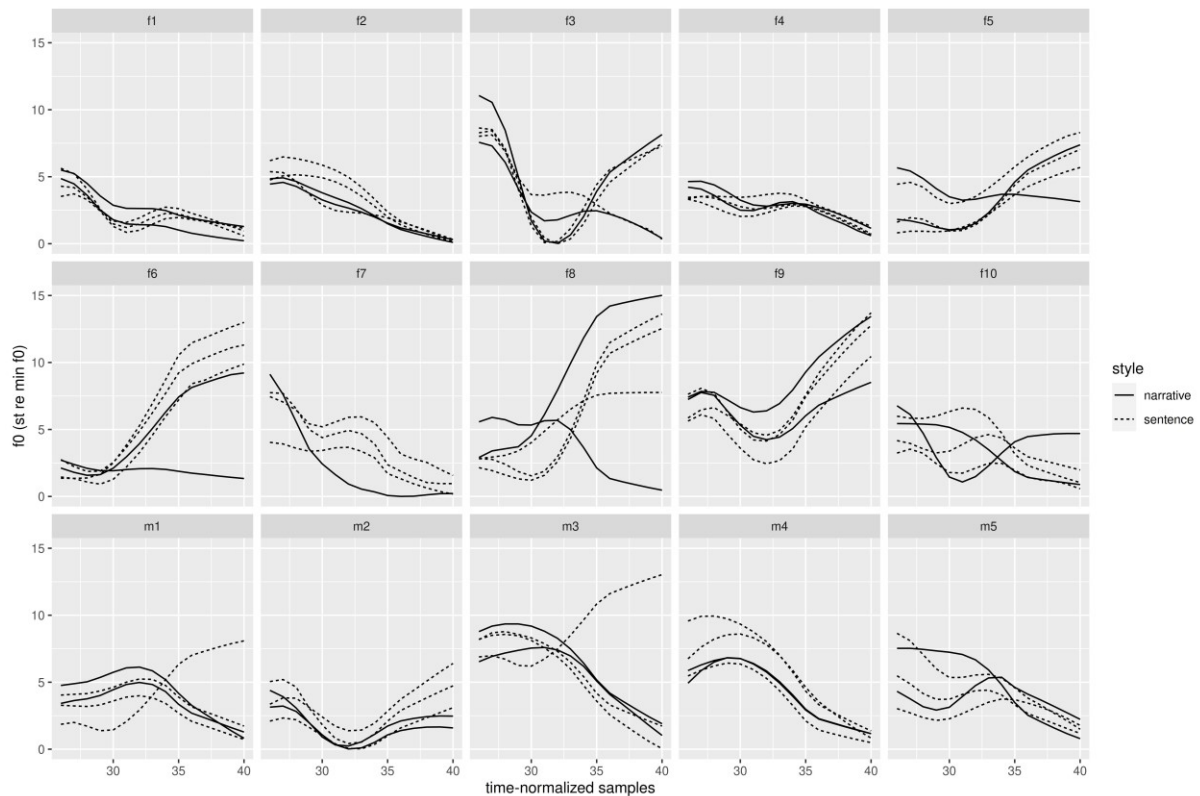


Figure 11. Time-normalized f_0 contours of yes-no questions by bilingual speakers of BP as L1 (BL1).

In wh-questions, shown in figure 12, there is a group of 8 speakers (*f1, f2, f7, f9, f10, m1, m2* and *m4*) that produces contours that are very similar to the ones seen in the monolingual BP group (see Figure 6) - an extra high initial tone in the wh-word and a smooth transition to a low nuclear accent. A second group of 4 speakers (*f5, f6, f8* and *m3*) produces contours with the typical BP L1 pattern, but also some that follow one of the two possible Spanish L1 patterns, either a high peak in the wh-word and a final rise in the nuclear position or an initial plateau followed by a circumflex in nuclear position. Speakers in this group vary in two dimensions: first, in the proportion of Spanish L1- to BP L1-like patterns they produced, and also in terms of which of the two Spanish L1 wh-question patterns they produce. Lastly, a third group of speakers (*f3, f4* and *m5*) produces contours that could be described as “hybrid”, that is, contours that simultaneously present characteristics of both Spanish L1 and BP L1 contours. In this case, the hybridization results in a contour that has a high or extra high initial peak in the wh-word (a BP L1 trait), followed by a circumflex in nuclear position (a Spanish L1 trait).

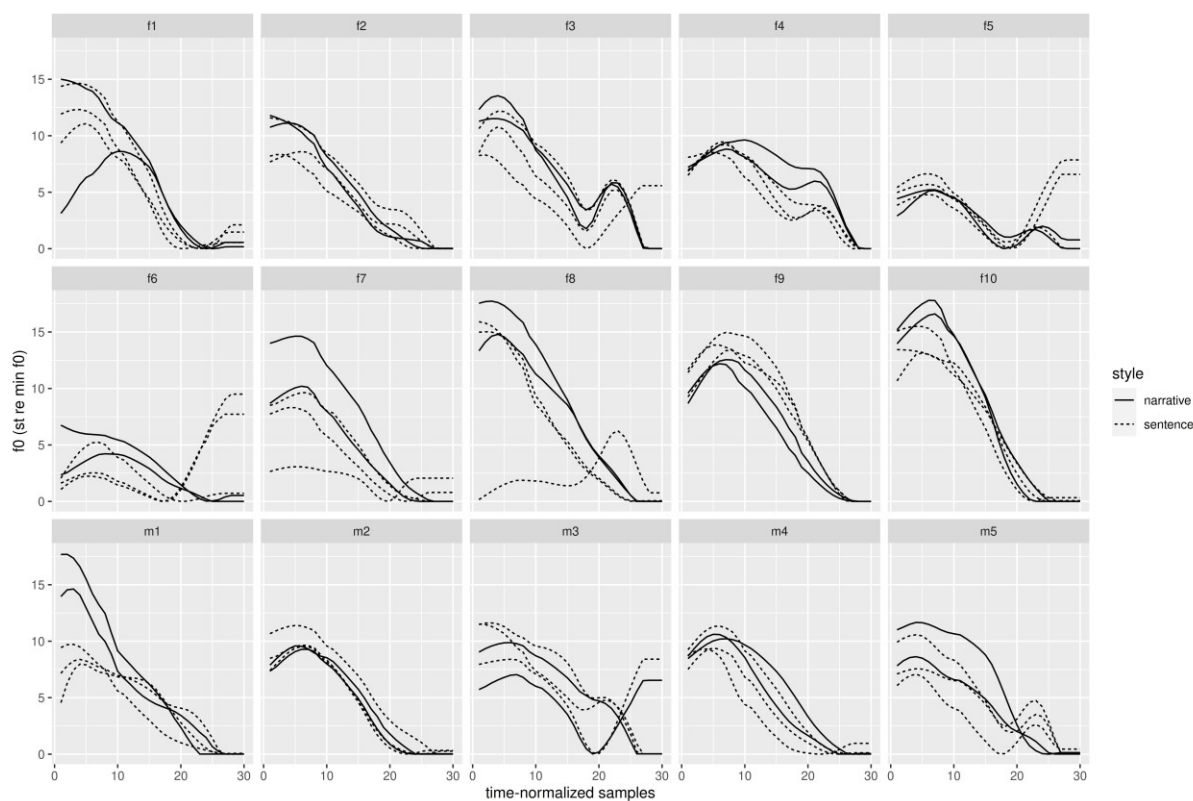


Figure 12. Time-normalized f_0 contours of wh-questions by bilingual speakers of BP as L1 (BL1).

5. DISCUSSION

The qualitative exam of L2 contours produced by bilingual speakers shows evidence of *learning*, that is, many Brazilian speakers are able to produce Spanish L2 contours close to the patterns observed in the production of monolingual Spanish speakers; we also see *transfer*, that is, some of the L2 contours produced by the Brazilian bilingual speakers are closer to the typical patterns seen in the production of Brazilian monolingual speakers. When looking at L1 contours produced by the bilinguals, the data shows the occurrence of *attrition*, an influence of L2 on the L1 production. The fact that we see the occurrence of the three phenomena is evidence of the complex nature of the learning process. The results suggest that factors affecting the L2 speakers (such as age of L2 learning, length of residence and others) and also the different intonational grammar of sentence modalities in L1 and L2 are sources of variability in the learning process. In the next paragraphs we try to tease apart and make sense of the different effects of these variability sources.

Looking at the results of L2 bilingual contours in yes-no questions (see figure 8), we identified a range of outcomes in terms of learning: a group of speakers that consistently produces native-like contours, a group that alternates between contours with a native-like shape and contours that resemble the L1 pattern and, finally, a group that systematically transferred the L1 pattern into the L2 performance. So, there is a gradient between nearly-native contour production and complete transfer that includes in-between situations. The speaker factor that seems to better correlate with the behavior of each group is the amount of experience with the L2. Speakers in the group with native-like contours have a median of 108 months of exposure to Spanish, combining both length of residence in Spain and length of formal instruction in Spanish prior to moving abroad. Speakers in the “in-between group”, those that exhibit both native-like performance and

L1 transfer have a median exposure to Spanish of 45 months. Speakers in the “100% transfer” group have a median of 48 months of exposure to Spanish. This observation suggests that exposure to L2 is an important factor in prosody learning, since speakers in the group with the best learning outcome have, in general, more than double the experience with the L2. On the other hand, the results suggest that length of residence or length of formal training are not enough to explain speaker variability in L2 learning. One speaker with 192 months of exposure to Spanish is in the “in-between” group and another with 156 months of exposure is in the “100% transfer” group. This is evidence that other factors are at play, at least for these two speakers.

Our results show that L2 prosody learning outcomes are also heavily influenced by the intonational structure similarity between L1 and L2. Spanish and BP differ in how the three sentence modalities studied here are structured intonationally. As explained in sections 2.1 and 2.2, declaratives are relatively similar in both languages, but questions differ in important ways. As we noted in section 4.2, in declaratives, most bilinguals show a good deal of learning, with approximately two thirds of speakers producing native-like contours. The others, nevertheless, are not far from the native-like performance; the differences are more quantitative than qualitative.

Yes-no and wh-questions, in contrast, present a different scenario. Among questions, yes-no are the most dissimilar between Spanish and BP in terms of the nuclear tonal inventory employed by each language. While Spanish always has a nuclear final rise, BP always presents a circumflex contour, thus ending the sentence with a fall, unless the nuclear accented word ends in a stressed syllable. The task of mastering the range of differences in tonal inventory between Spanish and BP can partly explain the gradience in learning outcomes described in the earlier paragraph. Difference in tonal inventory is one of the dimensions taken into consideration by the LILt model (MENNEN, 2015), to explain difficulties of L2 learners in L2 production.

Wh-questions pose yet a different learning challenge. Spanish has two possible patterns and BP has only one. The challenge is compounded by the fact that both Spanish contours share at least one similarity with BP contours. One shared trait is the initial peak or high starting point aligned with the interrogative pronoun, although Spanish has contour with a peak in the pronoun followed by a also a nuclear final rise that is absent in BP; the other possible Spanish contour has a plateau-like prenuclear section and a circumflex movement on the nuclear position. Although the BP wh-question contour ends in a low tone, circumflex movements are very frequent in BP in other modalities, making it a second shared trait. The challenge, then, is that although there is similarity, there is no coincidence. This difficulty shows up in the learning outcomes, as described in section 4.2. No speaker achieves native-like performance; approximately half of the speakers are “transfers”, that is, they produce a contour very similar to the L1 pattern; the other half can be divided in two qualitative groups; the first group produces what we called “hybrid” contours, that is, contours that simultaneously borrow elements that are typical of Spanish and BP contours; a second group produces what we call “blended” contours, that is, contours that are entirely different from both Spanish and BP typical contours.

Alongside the range of learning outcomes we described in the previous paragraphs, our results also revealed the presence of language attrition in the L1 production of the bilingual speakers. As with learning, attrition is also a highly variable phenomenon that is affected by both speakers and sentence modality. As we pointed out in section 4.2, for instance, in yes-no questions speakers can be divided in three groups based on the presence of attrition: a group with no attrition, one speaker that systematically produces L2-like contours and a third group whose contours are in-between L1 and L2. As for sentence modality as a source of attrition variability, if we

consider declarative sentences, which are structurally similar in Spanish and BP, attrition seems to manifest in a quantitative way as a softening of the fall segment of the circumflex contour in nuclear position. Wh-questions, unlike yes-no, have similarities in intonational structure in Spanish and BP and present a different attrition pattern: no speaker systematically produces L2-like contours; speakers that do produce L2-like contours do so in a lower proportion when compared to speakers in yes-no questions; most non-L1-like contours are cases of “hybrid” contours; in comparison, in yes-no questions, most non-L1-like contours are near copies of the L2 pattern; finally, for both types of questions, there is a similar number of speakers that show no signs of attrition.

As we pointed out, our results show convincing evidence for the presence of both learning and attrition in our data. This alone is interesting enough, given the restricted number of studies focusing Spanish as L2 learning by Brazilian speakers in both segmental and prosodic levels. The data also allowed us to look for an interaction between learning and attrition. Comparing the learning outcomes of speakers in the BL2 condition with the occurrence of attrition in their L1 production (BL1 condition), we found evidence that better learning performance is correlated with greater levels of attrition for a number of speakers. This pattern is suggested by the following finding: in yes-no questions, there are six speakers that produce near copies of the L2 pattern in the BL2 condition that at the same time present a high amount of attrition in their L1 production (BL1 condition). Additionally, looking at the data one can see that speakers that transfer the L1 contour patterns to L2 tend to not show loss of L1-like performance in the BL1 condition. This is true not only in yes-no questions. As noted before, in wh-questions there is overall a low level of L2-like contours among all speakers in the BL2 condition and also an overall low level of attrition. This finding can be seen as corroboration of one of Major’s (1992, p. 201) hypotheses concerning the L2-L1 influence, namely the one that predicts that “L2 proficiency is correlated with L1 loss”. This pattern, however, does not hold for all speakers: three of them do have native-like performance in yes-no questions in L2 (BL2 condition) and preserve L1-like performance in L1 (BL1 condition). Although there is speaker variation in this relationship, this variation does not seem to be random. In the case of the three speakers mentioned above, two of them report to use BP for 5 to 7 hours a week, suggesting that exposure to L1 might be a factor inhibiting attrition, although research on the impact of L1 use in L1 attrition indicates this relationship is not straightforward (SCHMID, 2007).

6. CONCLUSIONS

In the present study, we mostly relied on qualitative analysis of time-normalized contours of a small number of sentences, a decision that allowed us to concentrate on variability on the level of individual speakers. This was a conscious decision based on the authors’ experience with a much larger experiment (SILVA; ARANTES, 2021) run on a much larger corpus, of which the present material is a subset, where they observed large amounts of variability in the intonation production of bilinguals. The smaller scale and qualitative methodology allowed us to identify in the present study patterns in learning and attrition and also to identify speaker-specific behavior. We hope the patterns identified based on the qualitative analysis will serve as a basis for future studies that will further our understanding of the complex nature of the L2 learning process. One avenue we intend to explore is the quantitative analysis of f_0 contours that may help to characterize gradient contour variation. One example of this is the slope of the fall segment in circumflex contours. As we noted in section 4.1, Spanish and BP seem to

differ in the steepness of the circumflex fall in monolingual speech. In our qualitative analysis, visual observation of contour shapes suggests bilinguals seem to have learned this gradient difference and even that some speakers might have introduced this less steep fall in their L1 production. This observation should be confirmed by a quantitative analysis. Three dimensions in which contours may differ are the number, height and alignment of peaks and contours in both languages can differ based on that. Peak count and alignment are also something that could be quantified to make the analysis more objective. For instance, it could be determined if the height of the initial high tone in wh-questions in Portuguese is in fact higher than in Spanish and if the second peak in declarative sentences in Spanish is in fact systematically downstepped relative to the first. Finally, in future studies we plan to explore in more detail the correlation between learning and attrition behavior with speaker factors such as length of residence, amount of formal instruction in L2, amount of L1 use, age of L2 learning and others.

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